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(54) **ONE-WAY CLUTCH ASSEMBLY WITH DUAL BEARINGS**

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CPC ***F16D 41/066*** (2013.01); *F16D 2041/0605* (2013.01); *F16D 2041/0665* (2013.01)

(58) **Field of Classification Search**
CPC F16D 2041/0601; F16D 41/066; F16D 41/067; F16D 41/08; F16D 41/06
See application file for complete search history.

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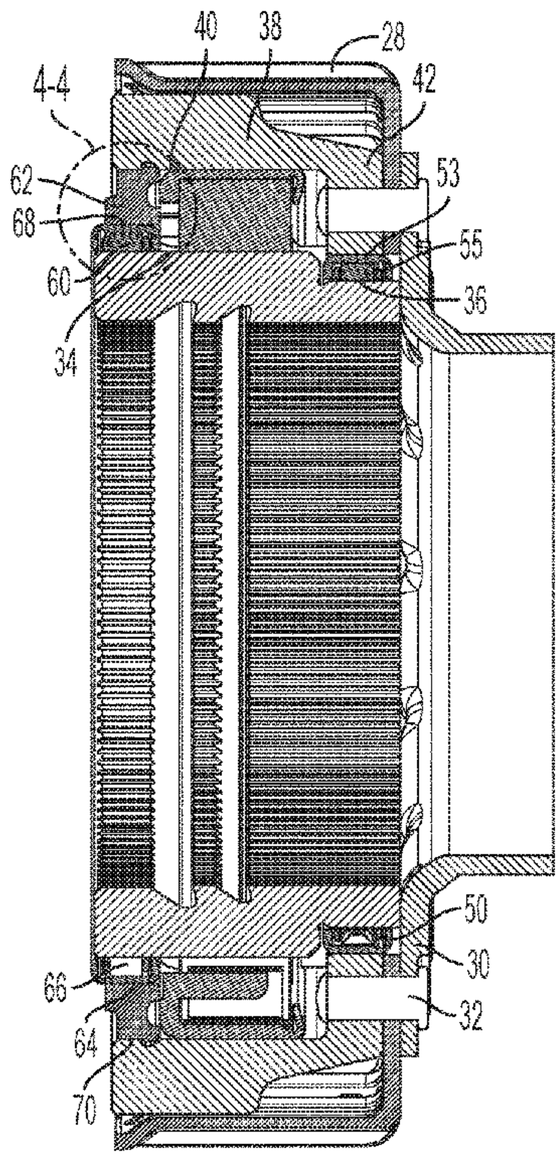
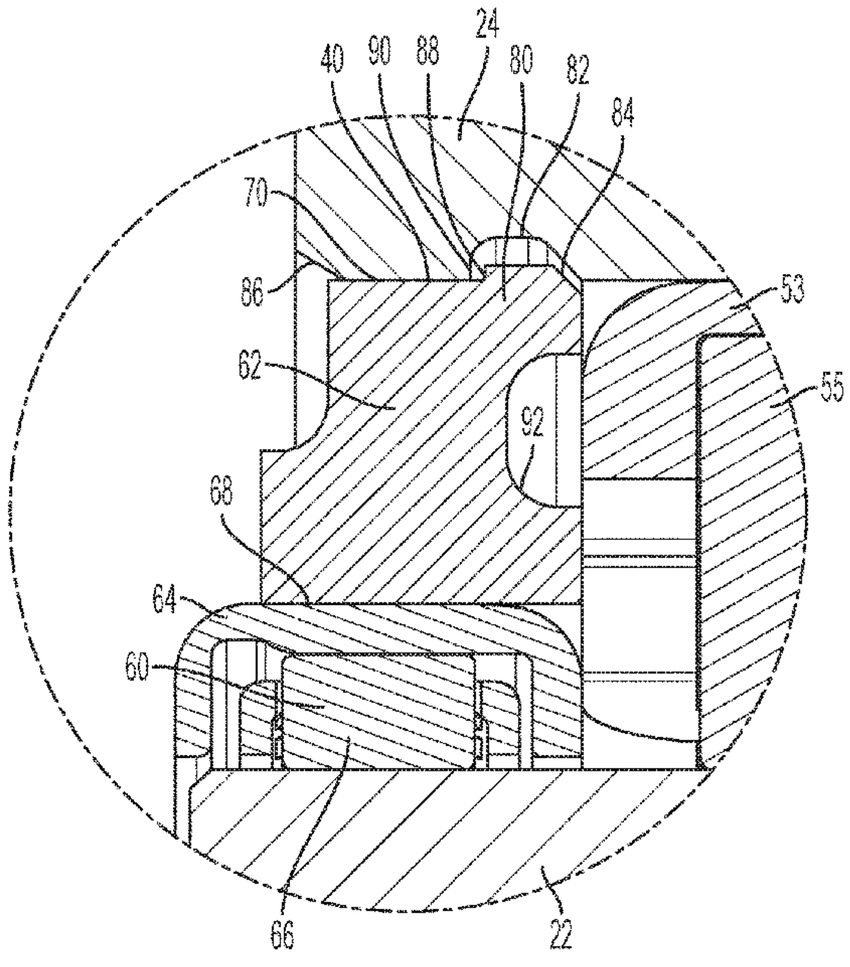
(57) **ABSTRACT**

A clutch assembly includes inner and outer races supported for rotation about an axis and a one-way clutch element radially disposed between the inner and outer races. A first bearing is radially disposed between the inner and outer races and is seated on the inner race. A second bearing is radially disposed between the inner and outer races and is seated on the inner race. The first and second bearings are on opposite sides of the clutch element.

20 Claims, 3 Drawing Sheets





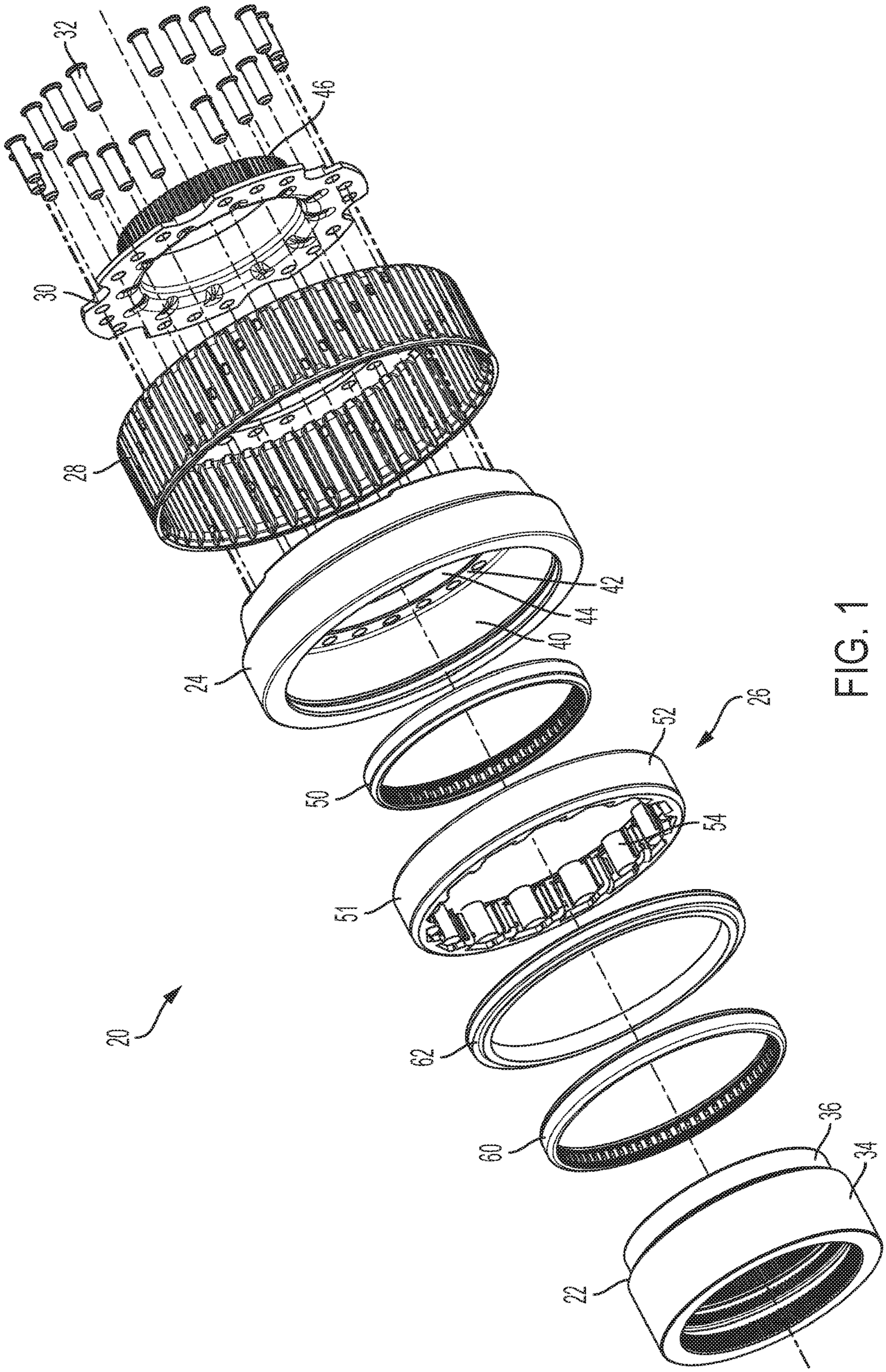


FIG. 1

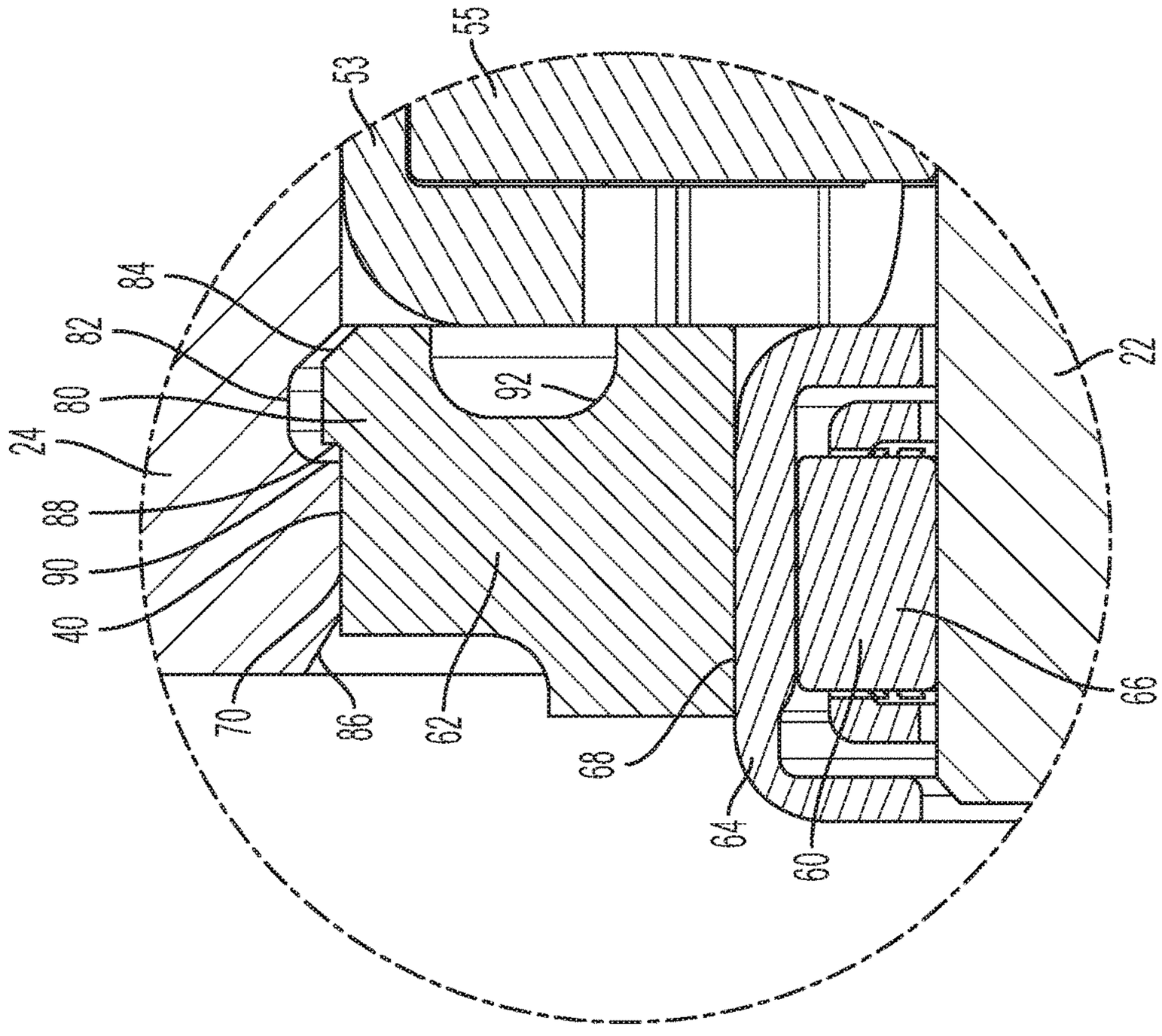

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FIG. 4

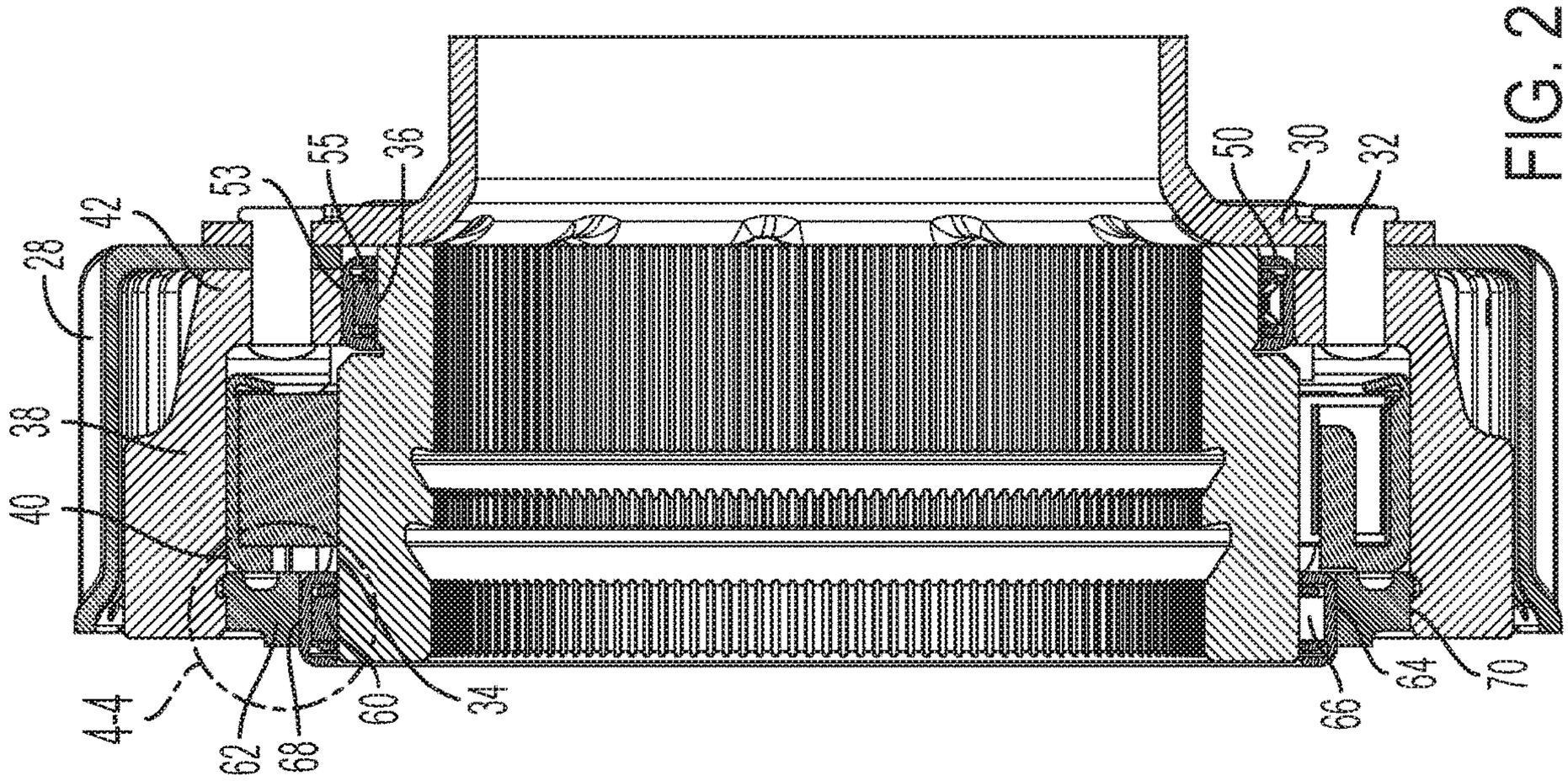
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FIG. 2

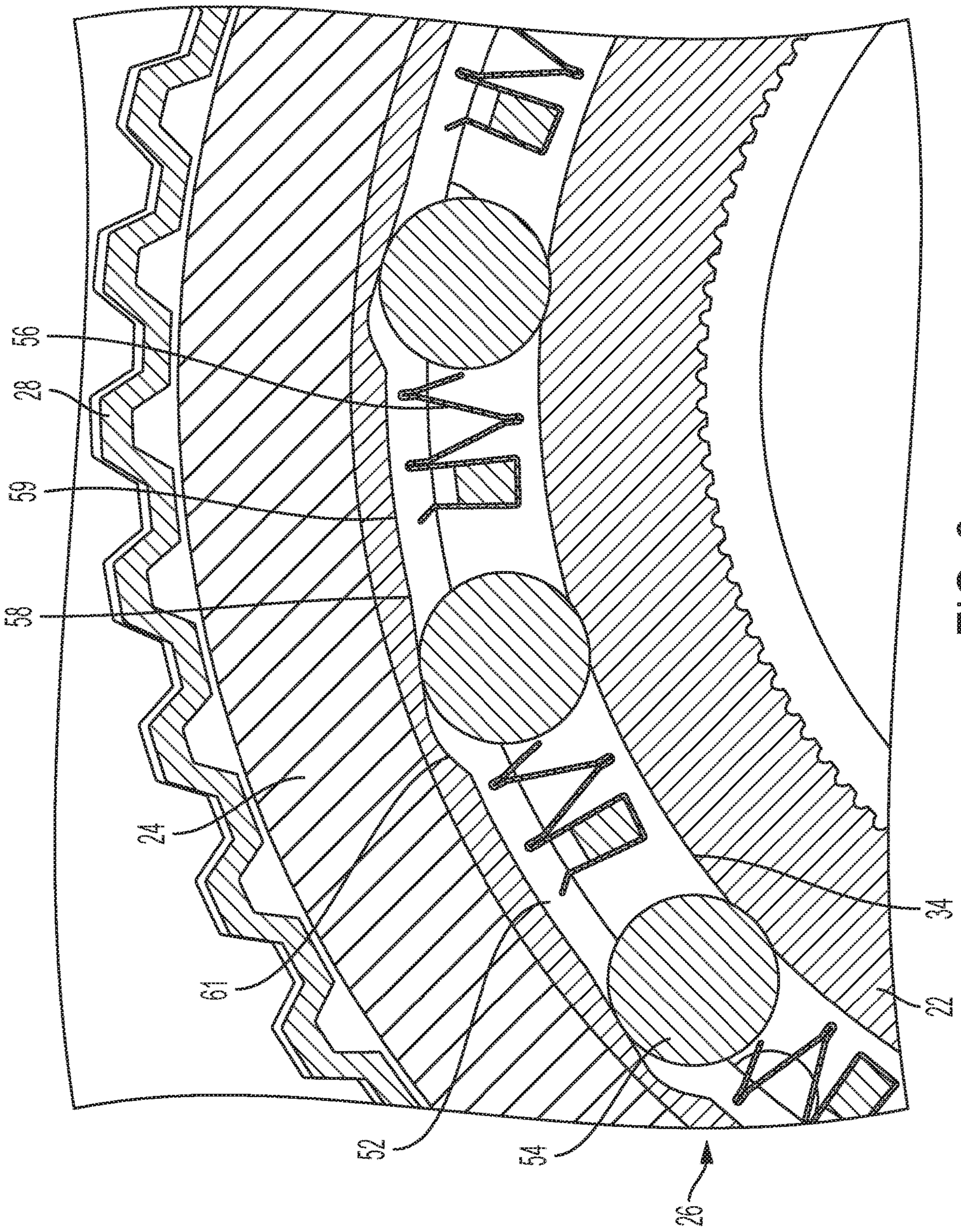

FIG. 3

ONE-WAY CLUTCH ASSEMBLY WITH DUAL BEARINGS

TECHNICAL FIELD

The present disclosure relates to one-way clutch assemblies and more specifically to clutch assemblies having dual bearings.

BACKGROUND

A clutch is a device used to selectively couple components such as a pair of rotating shafts or the like. A clutch may also be used to ground a rotating component to a fixed structure such as a housing. Here, the clutch is typically referred to as a brake. Clutches may be bidirectional, lock in both directions, or one-way, lock in one direction and freewheel in the other. U.S. Pat. No. 9,145,927 is an example of a one-way clutch.

SUMMARY

According to one embodiment, a clutch assembly includes an inner race defining first and second axially spaced seats and an outer race circumscribing the inner race and defining third and fourth axially spaced seats. A one-way clutch element is radially disposed between the inner and outer races and is disposed on the first and third seats. A first bearing is disposed on the second and fourth seats. An annular spacer of the clutch assembly has an outer surface disposed on the third seat. The clutch further includes a second bearing disposed on the first seat and on an inner surface of the spacer.

According to another embodiment, a clutch assembly includes inner and outer races supported for rotation about an axis and a one-way clutch element radially disposed between the inner and outer races. A first bearing is radially disposed between the inner and outer races and is seated on the inner race. A second bearing is radially disposed between the inner and outer races and is seated on the inner race. The first and second bearings are on opposite sides of the clutch element.

According to yet another embodiment, a clutch assembly includes inner and outer races supported for rotation about an axis and a one-way clutch element radially disposed between the inner and outer races. A first bearing is radially disposed between the inner and outer races and is seated on the inner race. A second bearing is radially disposed between the inner and outer races. An annular spacer is radially stacked with the second bearing and engages with one of the inner and outer races.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view of a one-way clutch assembly.

FIG. **2** is side cross-sectional view of the one-way clutch assembly.

FIG. **3** is a front cross-sectional view of the one-way clutch assembly.

FIG. **4** is a magnified view of the clutch at area **4-4**.

DETAILED DESCRIPTION

Embodiments of the present disclosure are described herein. It is to be understood, however, that the disclosed embodiments are merely examples and other embodiments can take various and alternative forms. The figures are not necessarily to scale; some features could be exaggerated or minimized to show details of particular components. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a representative basis for teaching one skilled in the art to variously employ the embodiments. As those of ordinary skill in the art will understand, various features illustrated and described with reference to any one of the figures can be combined with features illustrated in one or more other figures to produce embodiments that are not explicitly illustrated or described. The combinations of features illustrated provide representative embodiments for typical applications. Various combinations and modifications of the features consistent with the teachings of this disclosure, however, could be desired for particular applications or implementations.

Referring to FIGS. **1** and **2**, a one-way clutch assembly **20** includes an inner race **22** and an outer race **24** supported for rotation about a common axis. The inner and outer races **22**, **24** are operably coupled to either rotating components or to a rotating component and a fixed component. The assembly **20** may be referred to as a brake when utilized to ground a rotating component to a housing or other fixed structure. A one-way clutch element **26** is configured to selectively lock the inner and outer races **22**, **24** relative to each other in a first direction of rotation and to permit relative rotation between the inner and outer races in a second direction of rotation (freewheel).

The inner race **22** includes an outer surface defining a first bearing seat **34** and a second bearing seat **36** that are axially spaced from each other. The first bearing seat **34** may be axially longer than the second seat **36**, and the first seat **34** may have a larger diameter than the second seat **36**. The outer race **24** includes an axially extending portion **38** having an inner surface defining a third seat **40** and a radially extending portion **42** that forms a hub of the outer race. The radially extending portion **42** defines an inner circumferential surface that forms a fourth bearing seat **44**. The third bearing seat **40** may be axially longer than the fourth seat **44**, and the third seat **40** may have a larger diameter than the fourth seat **44**.

The outer race **24** is received in and fixed to a carrier **28**. A drive hub **30** is attached to the carrier **28**. For example, a plurality of rivets **32** may extend through the drive hub **30**, the carrier **28**, and the radially extending portion **42** of the outer race **24** to fix these three components together. The drive hub **30** may define an external spline **46** used to attach the clutch assembly **20** to a shaft, a gear, or other component.

A first bearing **50** is radially disposed between the inner and outer races **22**, **24**. The bearing **50** may include an outer race **53** disposed on the fourth seat **44** and a plurality of rollers **55** disposed on the second seat **36**. The bearing **50** could also be inverted with an inner race disposed on the inner race **22** and rollers disposed against the outer race **24**. The roller bearing **50** is but one example and other types of bearings may be used. The first bearing **50** may be interference fit (press fit) to the outer race **24**.

Referring to FIGS. **1**, **2**, and **3**, the clutch element **26** is radially disposed between the inner and outer races **22**, **24** and may be generally located at an axial midpoint of the inner race **22**. The clutch element **26** may be disposed between the first seat **34** and the third seat **40**. The clutch element **26** may include a cartridge **52** that supports a plurality of rollers **54** that are circumferentially arranged and rotatable relative to the cartridge **52**. The cartridge **52**

includes an outer surface **51** disposed on the third seat **40** of the outer race **24**. The rollers **54** are received on the first seat **34** of the inner race **22**.

The cartridge **52** has an inner surface **58** defining a plurality of ramps **59** circumferentially arranged around the inner surface **58**. The ramps **59** extend radially inward in the clockwise direction when viewed from the perspective of FIG. **3**. Pockets **61** are formed at the ends of the ramps **59** and are configured to receive the rollers **54** therein such that the rollers **54** do not contact the inner race **22** when received in the pockets **61**. Springs **56** bias the rollers **54** out of the pockets **61** During operation of the clutch **20**, rotation of the inner race **22** relative to the outer race **24** in the clockwise direction causes the rollers **54** to ride up the ramps **59** causing the clutch to lock, and rotation of the inner race **22** relative to the outer race **24** in the counterclockwise direction causes the rollers **54** to roll into the pockets **61** permitting slip between the cartridge **52** and the inner race **22**. As the angular velocity of the outer race **24** increases during freewheeling, centrifugal force seats the rollers **54** within the pockets **61** and out of contact with the inner race **22**, which reduces friction losses.

Single bearing clutch assemblies may have performance issues in certain applications in which centricity of the outer race is not tightly maintained. For example, external forces from mating components can cause wobble between the inner and outer races which could lead to clutch failure. As disclosed herein, this disclosure sets forth a clutch assembly that overcomes one or more of the performance issues of this prior-art clutch assembly. The improved clutch assembly of this disclosure, inter alia, includes a second bearing that may be disposed on the opposite side of the clutch element from the first bearing. This second bearing, in cooperation with the first bearing, inhibits wobble between the inner and outer races.

The improved clutch may also include a spacer associated with the second bearing to prevent loss of interference fit in the event that the outer race expands as the one-way clutch builds torque. The interference fit retains the second bearing in the clutch assembly, and a loss of interference can result in axial movement of the second bearing leading to clutch failure. As explained below in detail, the spacer includes a connection feature that engages with a connection feature of the outer race to maintain axial alignment of the second bearing when interference between the spacer and the outer race is reduced or lost.

Referring back to FIGS. **1** and **2**, the clutch assembly **20** includes a second bearing **60** that may mitigate the effects of wobble or other external forces. The first bearing **50** and the second bearing **60** may be disposed on opposite sides of the clutch element **26**. The second bearing **60** may include an outer race **64** and rollers **66**. The rollers **66** are disposed on the first seat **34** adjacent to the clutch element **26**. The second bearing **60** is circumscribed by a spacer **62**. The outer race **64** of the bearing **60** is disposed against an inner surface **68** of the spacer **62**. The bearing **60** may be interference fit to the spacer **62**. The spacer **62** includes an outer surface **70** that is disposed on the third seat **40**. An interference fit may be formed between the third seat **40** and the spacer **62**. The spacer **62** may be formed of metal, such as powdered metal. In one embodiment, the spacer **62** is steel to match the steel of the outer race **24**. Matching the material between the outer race **24** and the spacer **62** provides similar expansion rates and avoids galvanic corrosion.

Referring to FIG. **4**, the spacer **62** may include a connection feature that cooperates with a connection feature of the outer race **24** to maintain axial position of the spacer **62** in the event that the interference fit between the spacer **62** and the outer race is diminished or lost. In one embodiment, the spacers **62** include a projection **80** received within a groove **82** of the outer race **24**, or spacer **62** may define a groove that receives a projection of the outer race **24**. The projection **80** may extend radially outward from the outer surface **70** of the spacer **62**. The groove **82** may be defined in the third seat **40**. The projection **80** and the groove **82** may be annular. The projection **80** may include a chamfer **84**, and the outer race **24** may define a chamfer **86** that cooperates with the chamfer **84** to ease insertion of the spacer **62**. The projection **80** is configured to snap into the groove **82** when axially aligned. A barb **88** formed on the backside of the projection **80** engages with a radial wall **90** of the groove **82** to resist removal of the projection **80** from the groove **82**. A channel **92** (optional) may be formed in the front side of the spacer **62**. The channel **92** is used to control the deflection of the spacer **62** and is tunable parameter. In this instance, the spacer **62** is not axially centered with the rollers **66** and the channel **92** balances this offset.

In an alternative embodiment, the second bearing may circumscribe the spacer. The second bearing may have an inner race seated on the seat of the spacer and rollers riding on the outer race. An inner surface of the spacer is interference fit to the inner race. Connecting features are provided on the spacer and the inner race to retain the bearing if interference is lost.

While exemplary embodiments are described above, it is not intended that these embodiments describe all possible forms encompassed by the claims. The words used in the specification are words of description rather than limitation, and it is understood that various changes can be made without departing from the spirit and scope of the disclosure. As previously described, the features of various embodiments can be combined to form further embodiments of the invention that may not be explicitly described or illustrated. While various embodiments could have been described as providing advantages or being preferred over other embodiments or prior art implementations with respect to one or more desired characteristics, those of ordinary skill in the art recognize that one or more features or characteristics can be compromised to achieve desired overall system attributes, which depend on the specific application and implementation. These attributes can include, but are not limited to cost, strength, durability, life cycle cost, marketability, appearance, packaging, size, serviceability, weight, manufacturability, ease of assembly, etc. As such, to the extent any embodiments are described as less desirable than other embodiments or prior art implementations with respect to one or more characteristics, these embodiments are not outside the scope of the disclosure and can be desirable for particular applications.

The following is a list of reference numbers shown in the Figures. However, it should be understood that the use of these terms is for illustrative purposes only with respect to one embodiment. And, use of reference numbers correlating a certain term that is both illustrated in the Figures and present in the claims is not intended to limit the claims to only cover the illustrated embodiment.

PARTS LIST

20 clutch assembly
22 inner race
24 outer race
26 one-way clutch element
28 carrier

30 drive hub
32 rivets
34 first seat
36 second seat
38 axially extending portion
40 third seat
42 radially extending portion
44 fourth seat
46 spline
50 first bearing
52 cartridge
53 outer race
54 rollers
55 rollers
56 springs
58 inner surface
59 ramps
60 second bearing
61 pocket
62 Spacer
64 outer race
66 rollers
68 inner surface
70 outer surface
80 hook
82 groove
84 chamfer
86 chamfer
88 barb
90 radial wall
92 channel

What is claimed is:

1. A clutch assembly comprising:

an inner race defining first and second axially spaced seats, wherein the first seat has a continuous diameter;

an outer race circumscribing the inner race and defining third and fourth axially spaced seats, wherein the third seat has a continuous diameter and defines a circular groove radially recessed into the third seat and having a radially extending wall;

a one-way clutch element radially disposed between the inner and outer races and disposed on the first and third seats;

a first bearing disposed on the second and fourth seats;

an annular spacer including an outer surface disposed on the third seat and a projection extending radially outward from the outer surface and received within the groove, wherein the projection defines a radially extending barb engageable with the radially extending wall to form axial interference between the barb and the radial wall that prevents axial movement of the spacer; and

a second bearing disposed on the first seat and on an inner surface of the spacer.

2. The clutch assembly of claim **1**, wherein the first and second bearings are on opposite sides of the clutch element.

3. The clutch assembly of claim **1**, wherein the second seat has a continuous diameter and the fourth seat has a continuous diameter.

4. The clutch assembly of claim **1**, wherein the outer surface of the spacer is interference fit to the third seat and the second bearing is interference fit to the inner surface of the spacer.

5. The clutch assembly of claim **1**, wherein the first bearing has a smaller diameter than the second bearing.

6. The clutch assembly of claim **1**, wherein the clutch element includes a cartridge and rollers supported by the cartridge, wherein an outer surface of the cartridge is disposed on the third seat and the rollers are disposed on the first seat.

7. The clutch assembly of claim **1**, wherein the spacer further includes a radially extending side facing the clutch element and defining a circular channel.

8. The clutch assembly of claim **1**, wherein the projection includes a chamfered leading edge.

9. A clutch assembly comprising:

an inner race defining first and second axially spaced seats;

an outer race circumscribing the inner race and defining third and fourth axially spaced seats;

a one-way clutch element radially disposed between the inner and outer races and disposed on the first and third seats;

a first bearing disposed on the second and fourth seats;

an annular spacer including an outer surface disposed on the third seat, wherein the spacer and the outer race include cooperating connection features to axially restrain the spacer relative to the outer race, wherein one of the connection features is a groove defined in the third seat and the other of the connection features is a projection disposed in the groove, wherein the projection extends radially outward from the outer surface of the spacer; and

a second bearing disposed on the first seat and on an inner surface of the spacer.

10. The clutch assembly of claim **9**, wherein the projection defines a barb configured to engage with a radial wall of the groove.

11. The clutch assembly of claim **9**, wherein the groove is circular.

12. The clutch assembly of claim **9**, wherein the outer surface of the spacer is interference fit to the third seat and the second bearing is interference fit to the inner surface of the spacer.

13. The clutch assembly of claim **9**, wherein the first bearing has a smaller diameter than the second bearing.

14. The clutch assembly of claim **9**, wherein the clutch element includes a cartridge and rollers supported by the cartridge, wherein an outer surface of the cartridge is disposed on the third seat and the rollers are disposed on the first seat.

15. The clutch assembly of claim **9**, wherein the spacer further includes a radially extending side facing the clutch element and defining a circular channel.

16. The clutch assembly of claim **9**, wherein the second seat has a continuous diameter and the fourth seat has a continuous diameter.

17. A clutch assembly comprising:

inner and outer races supported for rotation about an axis, wherein the outer race includes an inner circumferential surface defining a recessed circular groove having a radially extending wall;

a one-way clutch element radially disposed between the inner and outer races;

a first bearing radially disposed between the inner and outer races and seated on the inner race;

a second bearing radially disposed between the inner and outer races; and

an annular spacer radially stacked with the second bearing and including a radially extending projection having a barb, wherein the projection is received within the groove with the barb abutting the radially extending wall to prevent axial movement of the spacer.

18. The clutch assembly of claim **17**, wherein the spacer includes an outer circumferential surface having the projection thereon and disposed against the outer race and includes an inner circumferential surface disposed against the second bearing.

19. The clutch assembly of claim **18**, wherein the outer surface of the spacer is interference fit to the outer race, and the second bearing is interference fit to the inner surface of the spacer.

20. The clutch assembly of claim **17**, wherein the first and second bearing are disposed on opposite sides of the clutch element.

* * * * *